A Battle of Taste and Environmental Convictions for Ecolabeled Seafood: A Choice Experiment

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Short Abstract: This paper describes a choice experiment addressing preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh seafood products. The primary emphasis is the potential trade-off between taste (i.e., a favored species) and the presence of an ecolabel, when multiple seafood products are available.

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Abstract

Empirical studies of consumer preferences for seafood ecolabels are relatively few, and typically address choices among labeled and non-labeled products of the same seafood species. Given that consumers often express strong preferences for certain seafood species, however, a more relevant assessment of consumer preferences would allow for choices among different seafood products of similar processed form, where some products bear ecolabels. This paper describes a choice experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. The context is designed to be similar to that which consumers face at fresh seafood counters. Results suggest that consumers are unwilling to choose a less-favored species (i.e., to sacrifice taste) based solely on the presence of an ecolabel.

Introduction

Ecolabeling programs typically evaluate the production processes of market goods with regard to established environmental standards set by independent third parties. If a production process meets these standards, the producer or marketer may purchase a license to use a specific label in its marketing. The label conveys to the consumer otherwise unobservable information concerning a product's environmental impact, and may be used to distinguish products produced using methods that are less deleterious to the environment or natural resources (Johnston et al. 2001; Teisl et al. 2002). The use and implications of ecolabels have received substantial attention in the literature in recent years, with published works addressing both theoretical and empirical aspects of labeling (e.g., Sedjo and Swallow 2000; Moon et al. 2002; Johnston et al. 2001; Loureiro et al. 2001; Blend and van Ravenswaay 1999; Nimon and Beghin 1999).

In the case of seafood markets, the use of ecolabels establishes a means to provide market-based incentives for sustainable fishery management, assuming that consumers are willing to pay a premium for labeled products (Johnston et al. 2001). Empirical studies of seafood ecolabels are relatively few, and include Wessells et al. (1999), Johnston et al. (2001), Teisl et al. (2002) and Jaffrey et al. (2001). Given the paucity of market data regarding ecolabeled seafood (particularly fresh seafood), most studies use data from stated preference survey instruments to estimate consumers' preferences and willingness to pay (WTP) for ecolabeled seafood products in hypothetical markets. In all cases, studies have revealed that consumers are willing to pay statistically significant premiums for ecolabeled seafood products.

The results of these studies notwithstanding, the literature provides limited information regarding consumer choices *among* different types (i.e., species) of seafood in the presence of ecolabels. For example, with the exception of unpublished work of Jaffrey et al. (2001), existing stated preference studies of seafood ecolabels assess choices when the consumer is faced solely with two samples of the same species and product form (e.g., labeled versus non-labeled salmon fillets). Results of these studies indicate that consumers prefer ecolabeled to the non-ecolabeled seafood products, and are willing to pay a premium to obtain labeled products of the same species. However, these studies fail to assess the potential impact of ecolabels under more realistic scenarios in which similar products from multiple species are available. Choices are rarely made among seafood products in a single-species setting. Rather, consumers at supermarket seafood counters or seafood markets are typically faced with a variety of fresh seafood choices. Hence, a more realistic and relevant assessment of consumer preferences would allow for choices among different seafood products, where some of those products may bear ecolabels.

In contrast to the single-species assessments of other work, Jaffrey et al. (2001) investigates consumer preferences for ecolabeled seafood over a wide range of fresh and processed products. However, while the survey of Jaffrey et al. (2001) incorporates a wide array of species, it presumes a context in which consumers substitute freely among seafood products regardless of processed state (e.g., smoked haddock is considered an alternative to canned tuna, fish fingers, salmon steaks and frozen prawns)—an assumption that may be of arguable validity. In contrast, the study described here presumes that a more realistic context would incorporate choices among different species of the same processed form (e.g., fresh seafood), such as one would encounter when choosing among products at a seafood counter in local supermarkets.

Choice among species is particularly significant in the fresh seafood market, given that consumers often express strong preferences for certain types of seafood species. For example, data underlying Johnston et al. (2001) indicate a common pattern in which consumers will frequently purchase one species of fresh seafood (e.g., cod), while rarely purchasing other types (e.g., salmon). This apparent tendency towards species-loyalty in fresh seafood purchases begs the question—will consumers choose a less-favored species based solely on the presence of an ecolabel? That is, will consumers sacrifice taste in order to obtain a label? The willingness of consumers to make such cross-species substitutions may have significant implications for the size of the consumer market for ecolabeled products, and hence for the efficacy of ecolabels as a means to encourage sustainable fisheries management.

This paper describes a choice experiment addressing consumer preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. The choice context is designed to be similar to that which consumers currently face at fresh seafood counters. The analysis relies upon data gathered from mail survey of randomly selected Connecticut households. In contrast to prior work which assesses WTP for ecolabels when faced with only a single seafood species, the primary emphasis here is the potential trade-off between taste (i.e., a favored seafood species) and the presence of an ecolabel, when multiple fresh seafood products are available.

The Model

To model seafood purchasing behavior, we assume that the principal household shopper chooses among various seafood products on a specific shopping occasion. Following Johnston et al. (2001), we assume that the quantity of seafood to be purchased is fixed in the short run. Moreover, this fixed quantity of seafood purchased—the amount required to feed the household—is known only to the respondent. This methodological approach is based on focus group evidence that incorporation of quantity purchased in the traditional manner would produce methodological misspecification (Mitchell and Carson 1989) in the survey instrument.

Given these assumptions, consumer choices among fresh seafood products are modeled using a random utility framework (Hanemann 1984), similar to that applied by Johnston et al. (2001). For a given consumer, utility from a seafood product j is assumed to be a function of a vector of product attributes $\mathbf{X_j}$. Here, product attributes include the species of the fresh seafood product (e.g., swordfish, salmon), the presence or absence of a particular ecolabel, and the cost of the product to consumers. The random utility model disaggregates utility into observable and non-observable (stochastic) components, such that

$$U(\mathbf{X_j}) = v(\mathbf{X_j}) + \varepsilon_j \tag{1}$$

where $U(\mathbf{X_j})$ represents the consumer's utility from seafood consumption, $v(\mathbf{X_j})$ represents the systematic or potentially observable component of utility, and ε_j represents the stochastic, or unobservable component.

If the consumer compares product $j=A$ to product $j=B$, she will prefer (or choose) product A if

$$\mathrm{U}(\mathbf{X_A}) > \mathrm{U}(\mathbf{X_B}), \tag{2}$$

such that

$$v(\mathbf{X_A}) + \varepsilon_A > v(\mathbf{X_B}) + \varepsilon_B, \tag{3}$$

Here, following rank-ordered conjoint methods (Holland and Wessells 1998; Green and Srinivasan 1978), survey respondents are presented with four different choice options, and asked to rank these options in order of their preference (i.e., according to (3)). This was chosen over the referendum or paired-comparison format due to the increased information provided by each response. Within a rank-ordered, random-utility framework (Beggs et al. 1981), a respondent provides the highest rank to the seafood product that provides the highest level of utility, based on (3) above. Lower ranks are the allocated successively, based on (3) and the anticipated utility from each product. The rationale of the model is that the individual compares all the choices, selects their most preferred (independent of the rankings of the remaining choices) then makes their next choice out of the remaining subset of choices. This process is iterated until all options are ranked.[1]

Because ranks are ordinal rather than cardinal and because the ranks given by each respondent are not independent, neither OLS, ordered probit, nor ordered logit specifications provide consistent parameter estimates. To address this problem we apply the rank-ordered logit model of Beggs et al. (1981), which allows for both the ordinal nature of the data and the lack of independence between observations for each respondent. This approach was also used in a previous study of demand for seafood safety information (Holland and Wessells 1998).

Following (1)-(3) above, let $U_i(\mathbf{X_j})$ represent the random utility that individual i derives from alternative j with an observable deterministic component $v_i(\mathbf{X_j})$ and a random component ε_{ij}. The observable $v_i(\mathbf{X_j})$ is assumed to be a linear function of the vector $\mathbf{X_{ij}}$ such that:

$$v_i(\mathbf{X_j}) = \mathbf{X_{ij}}\boldsymbol{\beta}, \tag{4}$$

where $\boldsymbol{\beta}$ is a conforming vector of parameters to be estimated. If individual i's observed ranking of $j=1...J$ choices is given by $\mathbf{R_i} = (r_1, r_2, ..., r_J)$, the resulting model allows one to specify the probability of $\mathbf{R_i}$ using the logistic distribution as (Beggs et al. 1981):

$$\pi(\mathbf{R_i}) = \prod_{h=1}^{J-1}[\exp(\mathbf{X_{ir_h}}\boldsymbol{\beta}) / \sum_{m=h}^{J}\exp(\mathbf{X_{ir_m}}\boldsymbol{\beta})] \tag{5}$$

For an independent sample of N individuals, ranking one set of seafood choices per-individual, the log-likelihood function is given by:

$$L(\boldsymbol{\beta}) = \sum_{i=1}^{N} \log \pi(\mathbf{R}_i) = \sum_{i=1}^{N}\sum_{h=1}^{J-1} \mathbf{X}_{\mathbf{ir_h}}\boldsymbol{\beta} - \sum_{i=1}^{N}\sum_{h=1}^{J-1}[\log \sum_{m=h}^{J} \exp(\mathbf{X}_{\mathbf{ir_m}}\boldsymbol{\beta})]\,. \qquad (6)$$

The maximum likelihood estimates of β are those that maximize the predicted probability of the observed sets of ranks. The log-likelihood function is globally concave and provides unique estimates of β which are consistent, asymptotically normal and asymptotically efficient.[2]

The Data

Although a very limited number of ecolabeled fresh seafood products are currently available in some U.S. markets[3], there are no publicly available data that allow testing of hypotheses regarding tradeoffs among fresh seafood species in the presence of ecolabels. Accordingly, this study follows Johnston et al. (2001) and Jaffrey et al. (2001), and uses choice experiment (i.e., stated preference) data to assess hypotheses in question. The data are drawn from a mail survey of Connecticut households completed during 2001. Survey development, including focus groups and pretests, required approximately three months during early 2001.

As outlined above, seafood choice questions asked respondents to rank four different fresh seafood products in order of preference. Species chosen for choice questions were salmon, cod, flounder and swordfish. These species were chosen based on their popularity and familiarity among seafood consumers, and because the represent relatively distinct types of finfish available in fresh seafood markets.[5] Each choice experiment (ranking) question incorporated one choice from each of the four species.

In addition to variation in species, the experimental design allowed for variation in price and the presence/absence of an ecolabel. Price levels for each species were chosen to be consistent with prevailing retail prices at the time of the survey. The ecolabel was described as a label that guaranteed no overfishing, following Johnston et al. (2001).[6] The survey also emphasized that within each species (salmon, cod, swordfish, and flounder) both labeled and non-labeled products shared the same color, quality and freshness. Hence, it was emphasized that the sole differences between the illustrated seafood products were the specified differences in species, prices, and labels.

In addition to choice experiment questions outlined, survey responses provided information concerning preferences and consumption patterns for fresh fish, the role of environmental factors in past purchasing behavior, and demographic characteristics. The survey also incorporated a question designed to determine each respondent's favorite seafood among the four considered in choice questions (cod, salmon, swordfish, flounder), ranked by taste only. Responses to this question allow the choice experiment data to be split systematically according to a respondent's baseline favorite seafood species.

This split-sample analysis allows one to assess potential tradeoffs between species and ecolabels among consumers with different prior taste preferences. For example, one might assess whether respondents with a *prior* taste preference for salmon (i.e., they rank salmon first by taste) would be willing to purchase another species (cod, swordfish, flounder) in order to obtain a label. Such tradeoffs may be assessed based on responses of this group to choice experiment questions. Similar analyses may be conducted for groups with differing prior taste preferences.

A standard fractional factorial main-effects experimental design was used to construct a range of survey questions with an orthogonal array of attribute levels, resulting in 54 choice questions divided among 27 unique booklets. Survey implementation was completed between

August and October. In total, 1,500 surveys were mailed to randomly selected Connecticut households, with sampling weighted according to each county's share of the total state population. Survey implementation followed a variant of Dillman's (2000) tailored survey design, incorporating multiple introductory and follow-up mailings. Of 1,414 deliverable surveys, 432 were returned, for a response rate of 31% of deliverable surveys. Of the returned surveys, 64 were dropped from the analysis due to significant item non-response. The final data are drawn from the remaining 368 complete and usable surveys. This results in 736 sets of ranking questions for the survey sample, totaling 2,944 observations (four observed rankings per question). Model variables and descriptive statistics from these observations are summarized in table 1.

While the survey response rate (31%) does not appear to be particularly high, it is important to view this response in light of the population from which the sample is drawn. Given the topic of the survey, one would expect that it would be relevant solely to seafood consumers (97% of respondents were consumers of fresh seafood). Although 1,414 surveys were delivered, it is likely that some of these households were not consumers of fresh seafood, and hence would not be a relevant target for the survey. Hence, the response rate for seafood consuming households in the sampled population is likely somewhat higher than is indicated by the 31% aggregate response rate. However, given that the percentage of fresh seafood consuming households among the sampled population is unknown, it is impossible to calculate the effective response rate among this group.[7]

Model Results

Results for the full-sample rank ordered logit model are shown in table 2, as estimated using maximum likelihood. Two specifications are illustrated. The "main effects" model includes only the primary independent variables characterizing species, price, and the presence of an ecolabel. In addition to these main effects, the "main and interactive effects model" includes a set of multiplicative interactions between household attributes (e.g., age, income, household size; see definitions in table 1) and main effects (e.g., price, label, and species). Hence, the main effects model may be viewed as a restricted specification of the main and interactive effects model.

Most model variables require little additional emphasis, over definitions and summary statistics provided by table 1. However, the specification of price in the two illustrated models is somewhat different than that typically applied in choice experiments, and hence warrants additional explanation. As mentioned above, price levels for each species were chosen to be consistent with prevailing retail prices at the time of the survey. That is, the experimental design allowed for three different price levels for each species, but these price levels differed across species to correspond with well-known differences in mean market prices.[4] This design introduces correlation between price and species, as one would find in actual seafood markets. This was done based on the guidance of focus groups, to avoid the potential for protest responses and methodological misspecification in the final instrument.[8]

Given the presence of this intended correlation, various statistical specifications of the price variable were tested in preliminary model versions, to assess which provided the best model performance. Based on results of these preliminary models, the final specification used for the price variable in table 2 is the *deviation* of the price illustrated in the choice question from the mean price for the species in question, such that

$$Price = P_j - P_{j,\,mean} \qquad (7)$$

where P_j is the stated price of species *j* in a particular choice question, and $P_{j,\,mean}$ is the mean price of the same species across the survey design. This price difference may be positive, zero, or negative. Although this price specification provides a somewhat improved model fit, fundamental model results are robust to different specifications of the price variable.

Both the main effects and interactive effects model are statistically significant at $p<0.0001$, based on likelihood ratio tests (main model $\chi^2=85.16$, df=5; interactive model $\chi^2=141.98$, df=58). However, a likelihood ratio test of restrictions between the main effects and interactive effects model ($\chi^2=56.82$, df=53, $p=0.33$) fails to reject the null hypothesis of zero joint influence of interactions between household attributes and main effects. Moreover, very few of the included interactions are individually statistically significant (i.e., one out of 53 interactions statistically significant at $p<0.05$, and none significant at $p<0.01$). Based on these results, we ground subsequent discussion and modeling in the simpler main effects model.

Main Effects Model Results

Within the main effects model, results match prior expectations, where such expectations exist. All species coefficients are statistically significant at $p<0.01$, with the exception of *swordfish*. This implies that both *salmon* and *flounder* are preferred to *cod* (the default value), but that respondents do not prefer *swordfish* to *cod*, on average. As expected, increases in price lead to reduced probability of choice. The presence of a label has a positive and statistically significant ($p<0.01$) effect on preferences. Hence, mirroring prior findings of Johnston et al.

(2001) and Jaffrey et al. (2001), model results suggest that consumers would be willing to pay a price premium for ecolabeled seafood products, reflecting the positive utility increment associated with these products.

The expected nature of these results notwithstanding, the primary focus of this analysis is not on the willingness to pay (WTP) for ecolabels, but rather on the tradeoff between preferred species (i.e., taste) and the presence of an ecolabel. On these grounds, the primary main effects model sends a mixed message. Based on the random utility model outlined above, coefficient estimates indicate the relative effect of each variable on the observable component of marginal utility, $v(\cdot)$. The coefficient estimate associated with *label* (0.20), indicating the relative strength of effect on marginal utility, is larger than that on *swordfish* (-0.03), approximately equal to that on *flounder* (0.21), and smaller than that on *salmon* (0.33). Based on these preliminary results only, one might conclude that the effect of a label on marginal utility may be in some cases sufficient to cause consumers to choose a seafood species that would otherwise not be chosen. For example, based on point estimates of marginal utility only, the model predicts that a representative respondent would choose labeled flounder over unlabeled salmon, *ceteris paribus*, even though salmon would be preferred were both products to be labeled (or unlabeled).[9] Hence, the choice of salmon (a preferred species, *ceteris paribus*) would be sacrificed in order to obtain a less-preferred species (flounder) bearing an ecolabel.[10]

Such simple arguments, however, are based on a broad definition of a representative consumer, and obscure the fact that consumers often enter seafood markets with the goal of purchasing a *specific* type of seafood. For example, a consumer may enter a seafood market with the intention of purchasing salmon (her favorite species by taste)—and then be confronted with a choice of unlabeled salmon versus other species that may bear a no-overfishing ecolabel. Here, the policy relevant question is not whether an *average* consumer would switch, for example, between salmon and flounder in order to obtain an ecolabel—only a small percentage of these consumers would have been in the market for salmon in the first place. Rather, the more relevant question is whether a consumer who enters the store with the *intention* of purchasing one species (e.g., salmon), will purchase another species instead (e.g., flounder), based solely on the presence or absence of a label. Assessment of the latter question requires an extension of the basic model.

Main Effects Model with Sub-samples by Favorite Seafood Species

To allow such issues to be addressed, the survey incorporated a question designed to determine each respondent's favorite seafood among the four considered in choice questions (cod, salmon, swordfish, flounder), ranked solely by taste. Responses to this question allow the choice data to be split systematically into four independent sub-samples, according to a respondent's baseline favorite seafood species. For example, the "Salmon Preferred" sub-sample includes choice experiment data for only those respondents who indicated, in the prior question, that salmon was their most preferred species, ranked solely by taste. In contrast, the "Flounder Preferred" sub-sample includes analogous data for those who indicated that flounder was their most preferred species, again by taste. Statistically independent rank ordered logit results are estimated for each sub-sample.

The resulting four main effects models—one for each species specific sub-sample—allow one to address stated choice behavior of respondents who are known to prefer a specific species, by taste, *ceteris paribus*. For example, the Salmon Preferred model allows one to assess whether the presence or absence of an ecolabel would be sufficient to cause *a priori* salmon-preferring respondents to choose another species of fresh seafood. Analogous questions may be addressed in each of the four sub-sample models. That is, *assuming* that respondents would be more likely to begin a shopping trip with the intention to purchase their favorite species (by taste), the models allow one to assess whether the presence of an ecolabel on competing species would be sufficient to cause a change in this intended behavior.

Results for the four sub-sample models are shown in table 3. In three of the four models (Salmon Preferred, Swordfish Preferred, and Flounder Preferred), *cod* remains the omitted (or default) species dummy variable. In the fourth model (Cod Preferred), *swordfish* is the default. This specification distinction is made solely for convenience and ease of discussion; it does not affect model results. As above, all models are significant at $p<0.0001$, based on likelihood ratio tests. Interestingly, while the price variable (*price*) is highly significant in the Salmon Preferred and Swordfish Preferred model, it is not statistically significant in the Cod Preferred and Flounder Preferred models. This finding is robust over a wide range of specifications for the price variable and overall model. The reason for this finding most likely relates to particular preference structures among those who prefer the taste of flounder and cod.[11]

Implications for Seafood Ecolabeling: Does Taste Trump Environmental Conviction?

As expected, coefficient estimates indicate that respondents are most likely to choose the species that they rank most highly by taste, *ceteris paribus*. However, more relevant and interesting are the findings with regard to the effects of ecolabels. Recall that coefficient estimates in each model indicate the relative effect of each variable on the observable component of marginal utility, $v(\cdot)$. Based on this interpretation, and assuming mean prices for each species, table 4 illustrates the observable (relative) utility associated with different product configurations, for each sub-sample. Specifically, for each sub-sample, the utility increment associated with the unlabeled *preferred* species is compared to that associated with labeled variants of the other three species considered.

For example, for the Salmon Preferred Model, table 4 compares the utility increment associated with *unlabeled* salmon (the preferred species, by taste) to that associated with *labeled* swordfish, flounder, and cod (less preferred species, by taste). Results indicate whether the utility gain associated with the presence of an ecolabel is sufficient to offset the utility loss associated with the choice of a less-favored species (again assuming mean prices). Numbers in parentheses are associated p-values for the null hypothesis of zero difference between the relative marginal utility of the labeled species in question and the marginal utility of the unlabeled preferred species.

As shown in table 4, there is no instance in which the presence of an ecolabel on a less-favored species (by taste) is sufficient to offset the positive utility associated with the most favored species (by taste). The difference in relative marginal utility associated with the unlabeled preferred species is positive and statistically significant in all cases ($p<0.02$), and at $p<0.0001$ in ten of the twelve cases assessed. The presence of a price premium (i.e., increase in price) on ecolabeled products would further exacerbate the relative utility loss associated with the less-favored species.

For example, model results indicate that those who rank salmon first by taste (i.e., those in the Salmon Preferred model) will, on average, gain greater utility from the choice of salmon, regardless of the presence of ecolabels on competing seafood species—this difference is statistically significant at $p<0.0001$ in all cases. Those who rank other species first by taste are similarly predicted to gain greater utility from the favored species, again regardless of the presence of ecolabels on other species. These differences are universally statistically significant, and are of particularly large magnitude for those with taste preferences for milder fish (i.e., cod, flounder)

These results indicate that, on average, respondents with a prior taste preference for one species (i.e., they rank that species first by taste) will continue to choose that species as their primary purchase option, regardless of the availability of no-overfishing ecolabels on competing seafood products. This result applies to all species in all sub-sample models. Hence, while consumers may prefer (and by willing to pay a premium for) ecolabeled products in a single-species choice setting—or when labeled and unlabeled products are available for a favored species—model results suggest that they are much less willing to sacrifice a favored species. For the average consumer, taste trumps environmental convictions.

These results are particularly notable given the results of a prior survey question: 'Is certification important enough for you to buy a different kind of seafood?' Responses to this yes/no question indicated that 67% of respondents consider no-overfishing certification (i.e., the presence of an ecolabel) sufficient to cause them to change the type of seafood they buy. This response notwithstanding, choice experiment results suggest that the presence of a label is, on average, *insufficient* to cause consumers to give up a most-favored seafood species.

While the reason for this discrepancy is unknown, it may be related to the difference between a *general* willingness to switch seafood species versus a more *specific* willingness to switch between the particular types of species illustrated in choice questions. As noted above, the four species illustrated in the choice experiment questions were chosen based on their popularity to seafood consumers, and because they represent relatively distinct fresh seafood products that many consumers may not consider to be close substitutes. Approximately 67% of respondents expressed a general willingness to switch species in order to obtain a no-overfishing ecolabel, indicating that these respondents *may* be willing to switch among certain species—perhaps those perceived as very close substitutes (e.g., flounder and sole; cod and haddock). Nonetheless, choice experiment results indicate that respondents are *not* willing to switch among species that are more distinct (e.g., salmon, flounder, cod, swordfish), or more specifically are not willing to give up a favored species in return for an ecolabel.

Conclusions

This paper describes a rank-ordered choice experiment addressing stated preferences for ecolabeled seafood, in which the experimental design allows for choices among various fresh, non-processed seafood products. Results highlight the need for thorough analyses of consumer preferences for ecolabeled seafood, particularly given that ecolabels must compete with other valued attributes of fish to attract consumer purchases. Here, we assess potential tradeoffs between taste preferences and the presence of ecolabels.

Model results point to limitations in the ability of ecolabels to influence behavior in multi-species choice settings—even within a stated preference context. While results indicate a statistically significant WTP to obtain labeled seafood of a particular species, they also clearly indicate that consumers are not willing to sacrifice their most favored (by taste) seafood species in order to obtain a less-favored species bearing a no-overfishing ecolabel—even at average prices for both products. The preference for the favored-taste species is even more distinct if the ecolabeled product is sold at a premium price, and for those who favor mild-tasting species such as cod and flounder.

Results are, of course, relative to the specific case-study, species considered, and sampled population,[12] and are subject to the standard caveats regarding stated preference (i.e., hypothetical) data (e.g., Murphy and Stevens 2004). Results must also be viewed within the context of limitations imposed by the survey design—including the interpretation of results as contingent upon the requirement that consumers would be willing to "purchase" at least one of the four illustrated species.[13] Indeed, model results notwithstanding, consumers *may* be willing to substitute highly similar species (e.g., cod and haddock) in order to obtain ecolabels, as indicated by the greater than two-thirds of respondents who indicated a general willingness to switch seafood species in order to obtain a no-overfishing label. These limitations aside, the respondents' unwillingness to substitute dissimilar seafood species—even in return for an ecolabel— is clear, and represents a potential challenge to the use of labels as a means to promote sustainable fisheries.

More broadly, results suggest a potential shortcoming in analyses that assess consumer WTP for labeled products, yet do not allow for substitution (or lack of substitution) among different types of products. Most assessments of ecolabels, whether for seafood (Johnston et al. 2001), apples (Louriero et al. 2001), forest products (Sedjo and Swallow 2002), or other consumer goods, assume tradeoffs between labeled and unlabeled products of a single or otherwise unspecified variety. However, in most market settings, consumers choose from products of different varieties—whether different species of seafood, varieties of apples, or types of hardwood—often with a prior preference for the attributes of certain varieties. Assessment in multi-product settings may provide a more appropriate indication of the true size of the market for ecolabeled products, and hence for the potential impact of labels as a tool for environmental management.

Endnotes

1. As the rank-ordered model does not allow for a "status quo" response in which respondents may choose to purchase none of the presented products (Adamowicz et al. 1998), model findings should be interpreted as revealing factors that influence the choice of seafood products, conditional on the prior choice to purchase one of the available seafood options. Associated welfare results must be interpreted accordingly.

2. The standard independence of irrelevant alternatives assumption necessary for the multinomial logit model is assumed to hold at each level of ranking.

3. For example, one may now purchase Marine Stewardship Council certified salmon in Whole Foods Markets, a natural and organic supermarket chain (Alaska Seafood Marketing Institute 2001).

4. For example, survey scenarios presented flounder at a price of $4.99, $6.99, or $8.99 per pound. Swordfish, in contrast, was priced at either $6.99, $10.99, or $14.99 per pound.

5. Swordfish was also chosen as a result of the then-ongoing chef's boycott of Swordfish associated with SeaWeb's "Give Swordfish a Break" campaign (www.seaweb.org), a primarily East Coast reaction to U.S. imports of juvenile swordfish.

6. Other potential definitions of 'sustainable fishing' and specification of the ecolabel were tested in the focus groups (and in those reported by Johnston et al. (2001)), but only the guarantee of no overfishing was similarly and consistently understood by respondents.

7. Compared to census data for the sampled counties, survey results indicate a bias toward females, older age groups, and higher income. Given that the survey was specifically targeted at

the “primary seafood buyer” of the household, the relatively high female response rate was expected.

8. Focus group evidence and pretests for this survey and for the survey in Johnston et al. (2001) indicate that protest responses and confusion are often generated by surveys providing clearly unrealistic prices for seafood species. For example, respondents faced with fresh swordfish priced at $4.99 per pound (a very low price) may express disbelief at the realism of the scenario, or wonder whether the product is of low quality (e.g., previously frozen). To avoid such problems and associated methodological misspecification, the experimental design specified the mean price of each species to correspond with prevailing market prices at the time of the survey.

9. Observable marginal utility associated with unlabeled salmon at its mean price is 0.334. In contrast, observable marginal utility associated with labeled flounder at its mean price is equal to 0.408 = 0.208 + 0.200. Hence, for the average consumer, labeled flounder would be chosen over unlabeled salmon, based on the observable component of utility. However, in the absence of a label, utility associated with salmon (0.334) exceeds that associated with flounder (0.208). One could illustrate the same results using WTP instead of marginal utilities to compare seafood products. However, no additional intuition would be gained by doing so.

10. Willingness to pay (WTP) results are not illustrated here. Because the choice scenario—as is common in applications of rank ordered logit models—does not allow for a “no-purchase” option, WTP estimates would be necessarily contingent upon the prior choice to purchase one of the illustrated seafood options. Given the potential for misinterpretation of such conditional WTP estimates, they are suppressed from the discussion of model results.

11. For example, those who prefer the milder taste of species such as cod or flounder may be unwilling to choose stronger-tasting fish (e.g., salmon, swordfish), even at extremely unfavorable price differentials. Essentially, these consumers may be unwilling to eat stronger-tasting fish, at nearly any positive price.

12. For example, Johnston et al. (2001) show significant differences in reactions to seafood ecolabels between US and Norwegian consumers.

13. As noted above, the survey does not include a “no-purchase” option.

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Table 1. Model Variables and Summary Statistics

Variable	Definition	Mean	Std. Dev.
Product Attributes			
Price	Specified product price minus mean product price over experimental design; see main text.	0.09	2.17
Label	Binary variable indicting the presence of an ecolabel that guarantees no overfishing (1 = present, 0 = absent).	0.64	0.48
Salmon	Binary variable: 1 if product is salmon; 0 if product is not salmon.	0.25	0.43
Swordfish	Binary variable: 1 if product is swordfish; 0 if product is not swordfish.	0.25	0.43
Flounder	Binary variable: 1 if product is flounder; 0 if product is not flounder.	0.25	0.43
Cod	Binary variable: 1 if product is cod; 0 if product is not cod.	0.25	0.43
Respondent Attributes			
age 18-35	Binary variable: 1 if respondent is between the ages of 18 and 35 (inclusive); 0 if respondent is not in this age category. Default category is respondents age 36-55.	0.13	0.34
age over 55	Binary variable: 1 if respondent is over the age of 55; 0 if respondent is not in this age category. Default category is respondents age 36-55.	0.29	0.46
household size less than 3	Binary variable: 1 if respondent's household has fewer than 3 members; 0 household has 3 or more members. Default category is households of 3 to 5 members.	0.55	0.50
household size more than 5	Binary variable: 1 if respondent's household has greater than 5 members; 0 household has 5 or fewer members. Default category is households of 3 to 5 members.	0.02	0.13
income less than 55K	Binary variable: 1 if respondent's household income is less than $55,000 (US); 0 if income is not in this category. Default category is income between $55,000 and $100,000.	0.27	0.44
income over 100K	Binary variable: 1 if respondent's	0.30	0.46

	household income is more than $100,000 (US); 0 if income is not in this category. Default category is income between $55,000 and $100,000.		
low seafood expenditures	Binary variable: 1 if household's average seafood expenditures are less than $7.50 per week; 0 if expenditures are not in this category. Default category is expenditures between $7.50 and $12.50 per week.	0.35	0.48
high seafood expenditures	Binary variable: 1 if household's average seafood expenditures are more than $12.50 per week; 0 if expenditures are not in this category. Default category is expenditures between $7.50 and $12.50 per week.	0.31	0.46
member of environmental group	Binary variable: 1 if respondent considers him/herself a member of an environmental organization; 0 if respondent does not consider him/herself a member.	0.16	0.37
frequent seafood consumer	Binary variable: 1 if respondent consumes seafood more than once per month, on average; 0 if respondent does not consume seafood with this frequency.	0.85	0.36
feel salmon overfished	Binary variable: 1 if respondent thinks that salmon is overfished to at least some degree; 0 if respondent does not consider salmon overfished or is unsure.	0.36	0.48
feel swordfish overfished	Binary variable: 1 if respondent thinks that swordfish is overfished to at least some degree; 0 if respondent does not consider swordfish overfished or is unsure.	0.44	0.50
feel flounder overfished	Binary variable: 1 if respondent thinks that flounder is overfished to at least some degree; 0 if respondent does not consider flounder overfished or is unsure.	0.33	0.47
feel cod overfished	Binary variable: 1 if respondent thinks that cod is overfished to at least some degree; 0 if respondent does not consider cod overfished or is unsure.	0.39	0.49

Table 2. Estimation Results of Main Effects and Interactive Effects Models

Variable	Main and Interactive Effects Model			Main Effects Model		
	Coefficient	P-Value	Hazard Ratio	Coefficient	P-Value	Hazard Ratio
Main Effects						
Price	-0.039	0.322	0.962	-0.036	0.0004	0.965
Label	0.128	0.401	1.137	0.200	0.0001	1.222
Salmon	0.117	0.563	1.125	0.334	0.0001	1.397
Swordfish	0.357	0.336	1.214	-0.031	0.6170	0.970
Flounder	0.194	0.066	1.429	0.208	0.0007	1.231
Interactive Terms						
Price x *age 18-35*	0.061	0.066	1.063			
Price x *age over 55*	-0.009	0.708	0.991			
Price x *frequent seafood consumer*	-0.006	0.843	0.994			
Price x *low seafood expenditures*	-0.059	0.031	0.942			
Price x *high seafood expenditures*	0.006	0.808	1.006			
Price x *household size less than 3*	0.036	0.127	1.037			
Price x *household size over 5*	-0.023	0.770	0.977			
Price x *income less than 55K*	-0.003	0.916	0.997			
Price x *income over 100K*	0.007	0.767	1.007			
Price x *member of environmental group*	-0.010	0.728	0.990			
Label x *age 18-35*	0.093	0.442	1.097			
Label x *age over 55*	-0.168	0.070	0.845			
Label x *frequent seafood consumer*	0.082	0.497	1.085			
Label x *low seafood expenditures*	0.040	0.706	1.041			
Label x *high seafood expenditures*	0.069	0.474	1.071			
Label x *household size less than 3*	-0.034	0.698	0.967			
Label x *household size over 5*	-0.025	0.942	0.976			
Label x *income less than 55K*	-0.033	0.747	0.968			
Label x *income over 100K*	0.016	0.865	1.016			
Label x *member of environmental group*	0.020	0.076	1.216			
Salmon x *age 18-35*	-0.243	0.137	0.784			
Salmon x *age over 55*	-0.029	0.813	0.971			

Salmon x frequent seafood consumer	0.288	0.066	1.333
Salmon x low seafood expenditures	-0.010	0.940	0.990
Salmon x high seafood expenditures	-0.124	0.335	0.883
Salmon x household size less than 3	0.199	0.089	1.221
Salmon x household size over 5	-0.026	0.944	0.975
Salmon x income less than 55K	-0.155	0.237	0.857
Salmon x income over 100K	0.195	0.122	1.216
Salmon x member of environmental group	-0.205	0.155	0.815
Salmon x feel salmon overfished	-0.061	0.519	0.941
Swordfish x age 18-35	-0.091	0.575	0.913
Swordfish x age over 55	0.163	0.186	1.177
Swordfish x frequent seafood consumer	-0.269	0.802	0.764
Swordfish x low seafood expenditures	-0.168	0.208	0.846
Swordfish x high seafood expenditures	-0.008	0.953	0.992
Swordfish x household size less than 3	-0.006	0.958	0.994
Swordfish x household size over 5	-0.294	0.438	0.745
Swordfish x income less than 55K	0.133	0.322	1.142
Swordfish x income over 100K	-0.002	0.988	0.998
Swordfish x member of environmental group	-0.089	0.544	0.915
Swordfish x feel swordfish overfished	0.059	0.526	1.060
Flounder x age 18-35	-0.092	0.559	0.912
Flounder x age over 55	0.164	0.173	1.179
Flounder x frequent seafood consumer	-0.139	0.374	0.870
Flounder x low seafood expenditures	-0.019	0.889	0.982
Flounder x high seafood expenditures	-0.076	0.538	0.927
Flounder x household size less than 3	-0.081	0.479	0.922
Flounder x household size over 5	0.457	0.227	1.579
Flounder x income less than 55K	0.134	0.292	1.144

Flounder x *income over 100K*	-0.151	0.215	0.860		
Flounder x *member of environmental group*	-0.096	0.483	0.908		
Flounder x *feel flounder overfished*	0.108	0.261	1.114		
N	2160			2160	
Likelihood Ratio (-2 LnL χ^2)	141.9789	0.0001		85.1622	0.0001

Table 3. Main Effects Model: Sub-samples by Taste-Preferred Species

	Cod Preferred			Flounder Preferred		
Variable	Coefficient	P-Value	Hazard Ratio	Coefficient	P-Value	Hazard Ratio
Price	-0.003	0.912	0.997	-0.018	0.457	0.982
Label	0.022	0.869	1.022	0.242	0.021	1.274
Cod	1.908	0.0001	6.741	-	-	-
Salmon	0.181	0.309	1.199	-0.026	0.851	0.974
Swordfish	-	-	-	-0.345	0.014	0.708
Flounder	0.719	0.0001	2.052	0.898	0.0001	2.454
N	256			416		
Likelihood Ratio χ^2	89.1785	0.0001		72.1294	0.0001	

	Salmon Preferred			Swordfish Preferred		
Variable	Coefficient	P-Value	Hazard Ratio	Coefficient	P-Value	Hazard Ratio
Price	-0.049	0.002	0.952	-0.066	0.000	0.936
Label	0.455	0.0001	1.577	0.152	0.065	1.165
Cod	-	-	-	-	-	-
Salmon	1.556	0.0001	4.742	0.253	0.025	1.288
Swordfish	-0.053	0.586	0.948	0.735	0.0001	2.085
Flounder	0.184	0.059	1.201	0.244	0.030	1.276
N	856			632		
Likelihood Ratio χ^2	270.7584	0.0001		52.3527	0.0001	

Table 4. Relative Marginal Utility of Labeled versus Unlabeled Seafood: Split-Sample Results

	Model[b]			
Relative Marginal Utility at Mean Price[a]	Salmon Preferred	Swordfish Preferred	Flounder Preferred	Cod Preferred
Unlabeled Salmon	**1.556**	0.253	-0.026	0.181
Labeled Salmon	2.011	**0.405** **(0.0162)**	**0.216** **(0.0001)**	**0.203** **(0.0001)**
Unlabeled Swordfish	-0.053	**0.735**	-0.345	0.000
Labeled Swordfish	**0.402** **(0.0001)**	0.887	**-0.103** **(0.0001)**	**0.022** **(0.0001)**
Unlabeled Flounder	0.184	0.244	**0.898**	0.719
Labeled Flounder	**0.639** **(0.0001)**	**0.396** **(0.0171)**	1.140	**0.741** **(0.0001)**
Unlabeled Cod	0.000	0.000	0.000	**1.908**
Labeled Cod	**0.455** **(0.0001)**	**0.152** **(0.0001)**	**0.242** **(0.0001)**	1.930

a Results in **bold** highlight the relative marginal utility of the unlabeled preferred species (by taste), compared to labeled versions of competing species. The underscore highlights the relative marginal utility of the unlabeled preferred species. For example, in the Salmon Preferred model (those respondents who rank salmon first, by taste), the key comparison is that of unlabeled salmon to labeled swordfish, flounder, and cod; these results are highlighted in **bold**.

b For marginal utilities of competing species (bold with no underscore), numbers in parentheses indicate the statistical significance (**p-value**) of the *difference* between the marginal utility in question and the marginal utility associated with the unlabeled preferred species. For example, in the Salmon Preferred model, we reject the null hypothesis (at $p<0.0001$ in all cases) that the marginal utility of unlabeled salmon is equal to that of labeled swordfish, flounder, or cod.